about resource allocation, but physicians may still not give an unambiguous answer to the question, "How long have I got?"

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European Journal of Cancer Vol. 30A, No. 3, pp. 284–288, 1994
Printed in Great Britain.
0959–8049/94 $6.00+0.00

Pergamon

Papers

Prediction of Survival in a Hospital-based Continuing Care Unit

Janet R. Hardy, Rose Turner, Margaret Saunders and Roger A'Hern

Prediction of survival can be relevant in palliative care in those units with selective admission policies and limited resources, for planning patient management and in discharge planning for those patients expected to go home. In this study, factors most predictive of prognosis were identified. Those factors shown to have no effect on survival included the performance of investigations or procedures, anti-cancer therapy, morphine dose on admission and original admitting ward. Patients admitted primarily for pain control had a significant survival advantage over those patients admitted for palliation of some other symptom. Actual survival correlated well with predicted outcome. Factors most predictive of relative risk of death in a multivariate analysis were dyspnoea, decubitus ulcers, predicted outcome, interventions and a diagnosis of lung cancer. When symptoms alone were analysed, dyspnoea and immobility carried the highest relative risk of death.
Eur J Cancer, Vol. 30A, No. 3, pp. 284–288, 1994

INTRODUCTION

LENGTH OF survival is generally not an important end-point in palliative care where the emphasis is upon quality, not quantity, of life. However, some estimates of likely survival can be relevant: (1) in planning patient management, (2) in those units with selective admission policies and limited resources, (3) when formulating discharge plans, (4) when assessing patients for social security benefits.

Many hospices will only accept patients with a prognosis of weeks as their emphasis is on terminal care. Conversely, in a hospital-based palliative care unit, patients with such a poor prognosis are often best cared for in their original ward under the guidance of a palliative care team, and need not be transferred to another ward.

The Palliative Care Unit at the Royal Marsden Hospital is totally hospital-based and all referrals are from within the

hospital. The admission policy is selective; the early referral of patients is encouraged and the emphasis is on symptom control, rehabilitation and out-patient care. Over 60% of admissions end in discharge rather than death, and considerable time is invested by members of the multidisciplinary team in rehabilitation, and discharge planning for those patients expected to go home.

The aim of the study was to identify those factors which in this practice are predictive of a good prognosis and hence the likelihood of successful rehabilitation and eventual discharge. Similarly, the identification of those factors predictive of a very poor prognosis is relevant to the admission policy and in planning patient management.

MATERIALS AND METHODS

Data on all patients admitted to the Palliative Care Unit during a 6.5 month period (1 March 1990 to 13 September 1990) were entered on a weekly basis onto the Royal Marsden Hospital clinical research system, a computerised system for clinical data management and analysis. The information collected included: (1) basic data (sex, diagnosis, age), (2) presentation data (in-patient versus out-patient, original ward), (3) problems (pain, other symptoms), (4) expected outcome (discharge home, hospice transfer or hospitalisation until death), (5) in-patient management (investigations, procedures performed, anti-cancer treatment given, interventions), (6) discharge data.

Information relating to pain included type of pain (bone, visceral or other, including neuropathic), and morphine dose on admission. Expected outcome was predicted by the senior registrar following the weekly multidisciplinary meeting. Intervention is defined as specific referral to some member of the multidisciplinary team, for example, the physiotherapist, occupational therapist or pharmacist. Date of death was entered subsequently for survival analysis. Admission factors were then assessed independently and within a multivariate analysis against survival.

Tabulated data were analysed using the χ^2 test and Mann–Whitney test (for trend). Survival time was calculated from the first admission which occurred during the period being studied, prognostic factors being the values applying to this admission. Univariate analysis of survival data was undertaken using the log rank test [1], multivariate analysis was performed using the proportional hazards model [2].

RESULTS

During the 6-month period, there were 107 "new patient" admissions. Admission data (sex, age and diagnosis) are listed in Table 1. The median survival from first admission was 42 days (range 0–243). At time of analysis, 11 patients were still alive.

Presenting problems are listed in Table 2. Univariate survival analysis data are listed in Table 3. Those factors which were shown to have no affect on survival included the performance of investigations or procedures, anti-cancer therapy, morphine dose on admission and original admitting ward.

The 67 patients admitted to the ward primarily for pain control had a significant survival advantage over the 40 patients admitted for the palliation of some other symptom ($P < 0.01$) (Fig. 1). There was no difference, however, between those patients admitted with pain alone versus those admitted with pain plus another symptom (Fig. 2). The type of pain was not relevant. The prognosis was similar for patients with bone, visceral or other pain (including neuropathic pain) (Fig. 3).

Disease type was important, in that the survival of those patients with bronchial carcinoma was significantly shorter than those with breast, colon or prostate cancer (Fig. 4).

Actual survival correlated well with predicted outcome (Fig. 5), that is, those patients predicted to be discharged home or to be transferred to a local hospice lived longer than those patients predicted to die in hospital. Those patients in whom interventions were undertaken lived longer. The performance of procedures, e.g. paracentesis, nerve blocks, did not effect overall survival.

A multivariate analysis was performed considering all factors with respect to relative risk of death, excluding those with very small numbers, e.g. ascites, diarrhoea and obstruction (Table 4). Those predictive of a low risk were the performance of an intervention and a good expected outcome (predicted to return home after discharge). Conversely, the presence of dyspnoea, decubitus ulceration, a diagnosis of lung cancer or a poor expected outcome (predicted to be an in-patient until death) correlated with a high relative risk of death.

Symptoms alone were analysed in a separate multivariate

Table 1. Patients' characteristics

Sex	
Male	46
Female	61
Age (years)	
Range	24–87
Median	63
Diagnosis (number of patients)	
Breast	28
Colon	11
Unknown primary	6
Lymphoma	4
Brain	3
Bladder	1
Myeloma	1
Bronchus	21
Prostate	10
Ovary	2
Cervix	2
Melanoma	3
Sarcoma	2
Other	13

Table 2. Problems on first admission (number of patients)

Immobility	72	Depression	12
Pain	67	Fungating tumours	9
Constipation	38	Ulcerated wounds	7
Weakness	35	Diarrhoea	6
Nausea/vomiting	33	Mouth ulcers	5
Dyspnoea	28	Bowel obstruction	3
Anorexia	21	Ascites	2
Other	62		

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Revised 6 Oct. 1993; accepted 7 Oct. 1993.

Table 3. Univariate analysis of survival

Variable	Group	Number	Hazard ratio (95% CI)	*P* value
Investigations	None	27	1.00	ns*
	Simple	66	0.74(0.44–1.25)	
	Simple and complex	14	0.67(0.34–1.34)	
Procedures	No information available	1		ns
	None	77	1.00	
	Yes	29	0.92(0.59–1.44)	
Anti-cancer treatment	None	73	1.00	ns
	Yes	34	0.73(0.48–1.12)	
Morphine dose on admission (mg/day)	None	49		
	<60	22	1.00	ns*
	60–300	27	0.66(0.35–1.25)	
	>300	9	0.61(0.28–1.35)	
Admitting ward‡	A†	63	1.00	0.07
	B	9	2.61(0.92–7.36)	
	C	10	1.31(0.53–2.37)	
	D	7	1.00(0.51–3.36)	
Pain on admission	None	40	1.00	<0.01
	Yes	67	0.56(0.36–0.88)	
Symptoms on admission	Other	39	1.00	<0.02
	Pain	15	0.37(0.21–0.65)	
	Pain and other	52	0.65(0.42–1.03)	
	None	1		
Pain	None	40	1.00	<0.05
	Visceral	22	0.59(0.35–1.00)	
	Bone	29	0.62(0.38–1.02)	
	Other	16	0.42(0.24–0.73)	
Primary cancer	Breast	28	1.00	<0.05
	Lung	21	2.15(1.13–4.12)	
	Prostate	10	1.08(0.49–2.38)	
	Colon	11	0.94(0.42–2.07)	
Expected outcome	No available information	2		
	Home in days	45	1.00	<0.001*
	Home after rehabiliation	33	2.26(1.32–3.89)	
	Hospice placement	7	3.19(0.89–11.5)	
	In-patient to death	20	7.24(2.65–19.8)	
Intervention	None	16	1.00	<0.01
	Yes	91	0.47(0.22–0.98)	

* *P* value for trend, all others are tests of heterogeneity between groups. † Readmission to Palliative Care Ward. ‡ 18 patients were admitted from clinics rather than another ward. ns, non-significant.

analysis (Table 5). Dyspnoea and immobility carried the highest relative risk of death.

DISCUSSION

Although it is hoped that all patients admitted to the Palliative Care Ward benefit from the symptomatic treatment received, a considerable amount of time and effort is invested by members of the multidisciplinary team selecting patients for rehabilitation, and in discharge planning for those patients in whom discharge from hospital is considered likely. It was, therefore, useful to identify those factors which would most accurately predict prognosis to allow for the most efficient utilisation of resources available in the ward.

Several studies have shown that doctors are generally poor at predicting length of survival [3–6]. Addington-Hall and colleagues [7] have looked at the Spitzer quality of life index to help reduce prognostic uncertainty in terminal care and found that this index was not accurate enough to be used to predict what sort of treatment terminally ill patients require in the future and for how long. Bruera *et al.* [8] assessed activity, pain, nausea, depression, anxiety, anorexia, dry mouth, dyspnoea, dysphagia, weight loss and cognitive status in patients with advanced cancer admitted to a palliative care unit and related this to survival. There was a significant correlation between survival and dysphagia, cognitive failure and weight loss only. These three simple determinants could predict survival as well as the assessment of two skilled physicians.

In this study, expected outcome as predicted by an experienced senior registrar correlated well with survival, i.e. those patients expected to be discharged home lived longer than those patients expected to die in hospital or in a local hospice. The senior registrar was not asked to estimate survival time *per se* but

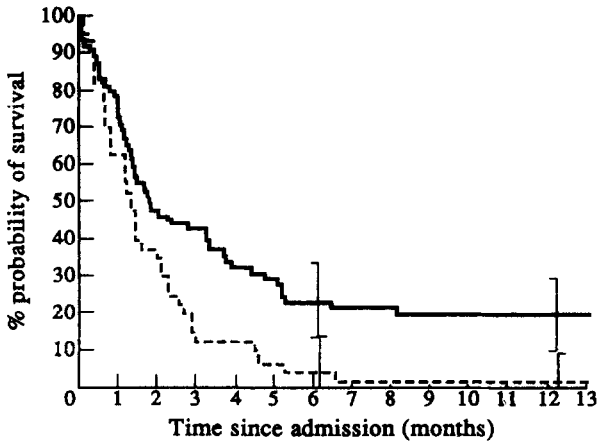

Fig. 1. Survival by pain. —— pain, $n = 67$. --- no pain, $n = 40$, $P < 0.01$.

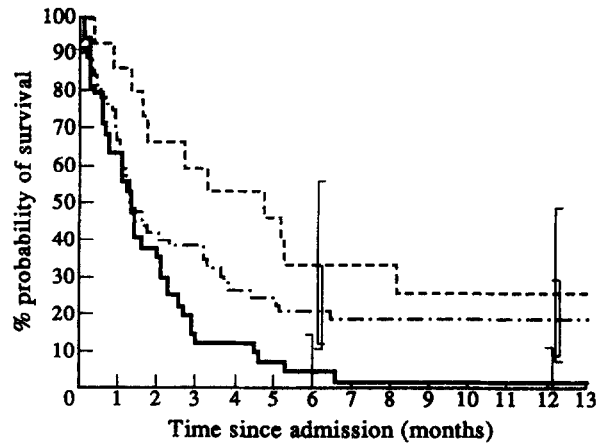

Fig. 2. Survival by symptoms. —— other than pain, $n = 39$, $P < 0.02$. --- pain, $n = 15$. –.–.–. pain and other, $n = 52$.

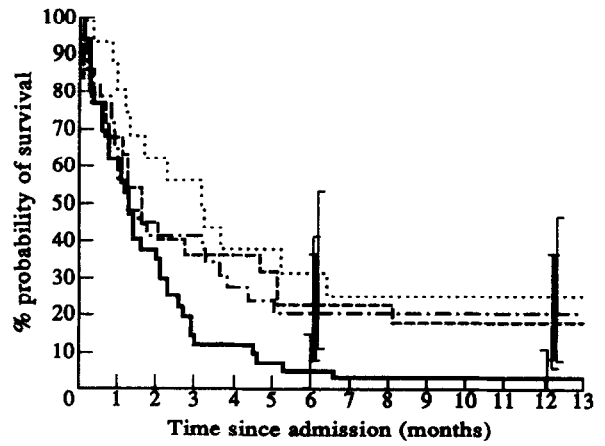

Fig. 3. Survival by pain type. —— none, $n = 40$, $P < 0.05$. --- visceral, $n = 22$. –.–.–. bone, $n = 29$. .... neuropathic and other, $n = 16$.

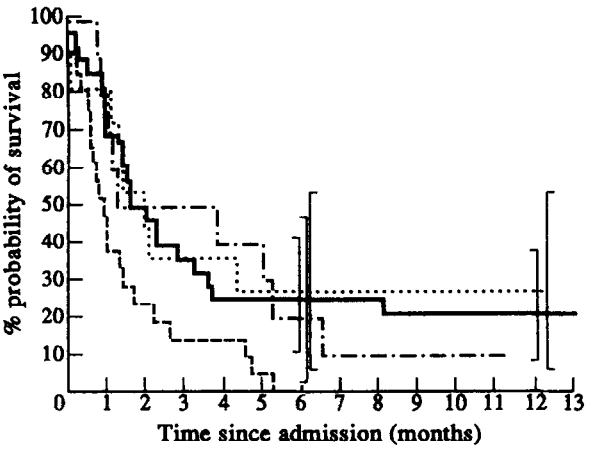

Fig. 4. Survival by primary cancer. —— breast, $n = 28$, $P < 0.05$. --- lung, $n = 21$. –.–.–. prostate, $n = 10$. .... colon, $n = 11$.

this is obviously closely associated with a prediction of outcome. It was encouraging that a doctor's assessment was one of the best predictors of the value of investment of resources in the hope that a patient may return home. This must depend greatly on the skill and experience of that individual, however, and with ever-changing staff, the use of other factors shown to carry precitive value must be preferable.

It might be said that the prediction of a senior registrar might be a "self-fulfilling prophecy", i.e. that a negative prediction might lead to the withholding of therapies or interventions which could have altered the course. It was shown in a univariate analysis, however, that the performance of investigations, procedures or anti-cancer therapy had no effect on survival. Therapies and interventions given to patients in this setting are given to relieve symptoms and are, therefore, unlikely to alter the ultimate course of disease in a patient dying of advanced malignancy.

The survival advantage of patients with pain illustrates the fact that pain is not usually an immediately life-threatening symptom as distinct from symptoms such as dyspnoea and obstruction. Once pain is associated with some other symptom, however, survival approaches that of patients with symptoms other than pain. One might expect visceral pain suggestive of organ infiltration to confer a worse prognosis than bone pain but this was not the case and the type of pain was not relevant.

The fact that those patients in whom interventions were

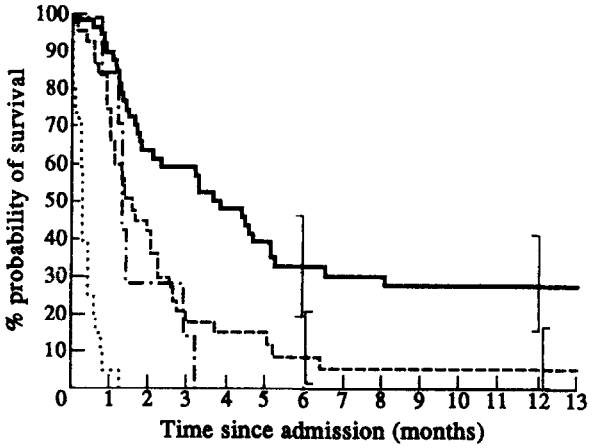

Fig. 5. Survival by expected outcome. —— home in days, $n = 45$, $P < 0.001$. --- home after rehabilitation, $n = 33$. –.–.–. hospice placement, $n = 7$. .... in patient to death, $n = 20$.

Table 4. Multivariate analysis of survival

Factor	Hazard ratio (95% confidence interval)	*P* value
Outcome		
Home within days	0.36(0.21–0.61)	< 0.001
Home after rehabiliation or placement to hospice	1.00	
In-patient until death	3.29(1.87–5.81)	
Site		
Lung	2.03(1.21–3.39)	= 0. 01
Other	1.00	
Intervention		
None	1.00	= 0. 02
Intervention	0.46(0.25–0.85)	
Problems		
Dyspnoea		
No	1.00	< 0. 01
Yes	2.04(1.26–3.31)	
Decubitus Ulcers		
No	1.00	= 0. 05
Yes	2.33(1.05–5.18)	

Table 5. Multivariate analysis—symptoms alone

Presenting problem		Hazard ratio (95% confidence interval)	*P* value
Dyspnoea	No	1.00	
	Yes	1.97(1.24–3.14)	< 0. 01
Constipation	No	1.00	
	Yes	1.74(1.10–2.78)	= 0. 02
Immobility	No	1.00	
	Yes	2.13(1.34–3.37)	< 0.001
Weakness	No	1.00	
	Yes	1.68(1.08–2.61)	= 0. 03

undertaken lived longer probably reflects the fact that they were considered well enough to benefit from involvement from non-medical members of the multidisciplinary team, e.g. physiotherapy or occupational therapy. Anti-cancer treatment may well have had a beneficial palliative effect but, not surprisingly, in this group of patients with far advanced disease, it did not affect survival. Similarly, the procedures and investigations performed were to aid in palliation rather than to save life.

The short survival of patients with lung cancer may reflect the natural history of the disease or the local practice in that these patients are referred relatively late in their disease as compared to those patients with breast or prostate cancer.

When presenting problems alone are analysed, ascites carries a grave prognosis, but the numbers in this group were small, thus excluded from analysis. The presence of dyspnoea and immobility carry the highest relative risk of death, as might be predicted, as these symptoms usually indicate far advanced disease which is imminently life threatening.

Therefore, in summary, the study would suggest that in this practice, time is well invested in rehabilitation and in formulating discharge plans for those patients who are admitted for pain relief, who are expected to be discharged home and who are considered well enough to be seen by non-medical members of the multi-disciplinary team.

Conversely, patients admitted with dyspnoea, immobility, constipation or weakness, especially if they have carcinoma of the lung and are not expected to be discharged home, are likely to have a very poor prognosis and should, therefore, be considered in this light when being reviewed by the team, to optimise their palliative treatment.

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